ISSN 2321 – 7359 EISSN 2321 – 7367

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Medical Science

Superior thyroid artery arising from the common carotid artery

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Received 23 July; accepted 27 September; published online 08 October; printed 28 October 2013

ABSTRACT

The neck dissection of a male cadaver revealed a thyroid gland having its left lobe supplied by a left superior thyroid artery arising from the left common carotid artery. There was a supra isthmic arterial arcade formed between the anterior branches of both the right and left superior thyroid arteries. The posterior branch of the left superior thyroid artery anastomosed with one of the ascending branches of inferior thyroid artery along the lateral border. The right lobe of the thyroid gland was supplied by a right superior thyroid artery arising from the right common carotid artery.

Key words: Superior thyroid artery, anterior branch, posterior branch, supra isthmic arterial arcade, inferior thyroid artery.

Abbreviations: STA – Superior thyroid artery, CCA – Common carotid artery, AB – Anterior branch, PB – Posterior branch, ECA – External carotid artery, CB – Carotid Bifurcation.

To Cite This Article

Sreekanth Tallapaneni, Mahabhashyam Vijaya Kumar, Waqia Sultana, Shaik Karimuddin Abdullah, Mohammed Salman Ali. Superior thyroid artery arising from the common carotid artery. *Medical Science*, 2013, 2(5), 20-23

1. INTRODUCTION

Thyroid gland is a 'H' shaped brownish red highly vascular endocrine gland. The blood supply is estimated to be relatively 3-4 times as great as that of the brain, and is six times as vascular as kidney (Mayo, 1926 and Tschuewsky, 1903). The STA is the principle source of arterial supply to the thyroid gland, upper part of the larynx and neck region. It is one of the first branch of external carotid artery (ECA) and arises just below the level of greater cornu of the hyoid bone. It runs downwards anteriorly under the cover of omohyoid muscle from its origin and gives rise to superior laryngeal artery that pierces the thyro hyoid membrane also gives an infra hyoid branch, crico thyroid branch and twig to the sternocleido mastoid muscle (Standring, 2005). It may also arise from common carotid artery (CCA) or from the bifurcation of CCA. The STA is the primitive artery to the gland and is a more constant vessel and is rarely absent (Quain).

Carotid triangle: The triangular area between the digastric muscle and stylohyoid (Antero-superiorly), superior belly of omohyoid (Antero-inferiorly), anterior border of the sternocleido-mastoid muscle (Posteriorly) is called carotid triangle. Its contents are common carotid artery with the carotid sinus and the carotid body at its termination, internal carotid artery; and the external carotid artery with its superior thyroid, lingual, facial, ascending pharyngeal and occipital, branches.

2. SCOPE OF THE STUDY

The field of study on vascular variations is not a closed track and needs to be frequently updated. The common carotid artery and its terminal branches namely external and internal carotid arteries are the main arterial trunks of head and

Comparison:

Although standard anatomical text books state that superior thyroid artery (STA) is a branch of external carotid artery ECA the latest research literature reports it to be different. As a higher incidence of STA arising from the point of carotid bifurcation (CB) or the common carotid artery (CCA) is discovered leading to a great impact on the terminology. It would be more apt to state that superior thyroid artery can be called as anterior branch of the common carotid artery.

Content:

In the history for the first time, Sir William Blizzard was the first surgeon who ligated the superior thyroid artery on one side at the London Hospital, but subsequently lost his patient due to secondary hemorrhage (Sir James berry).

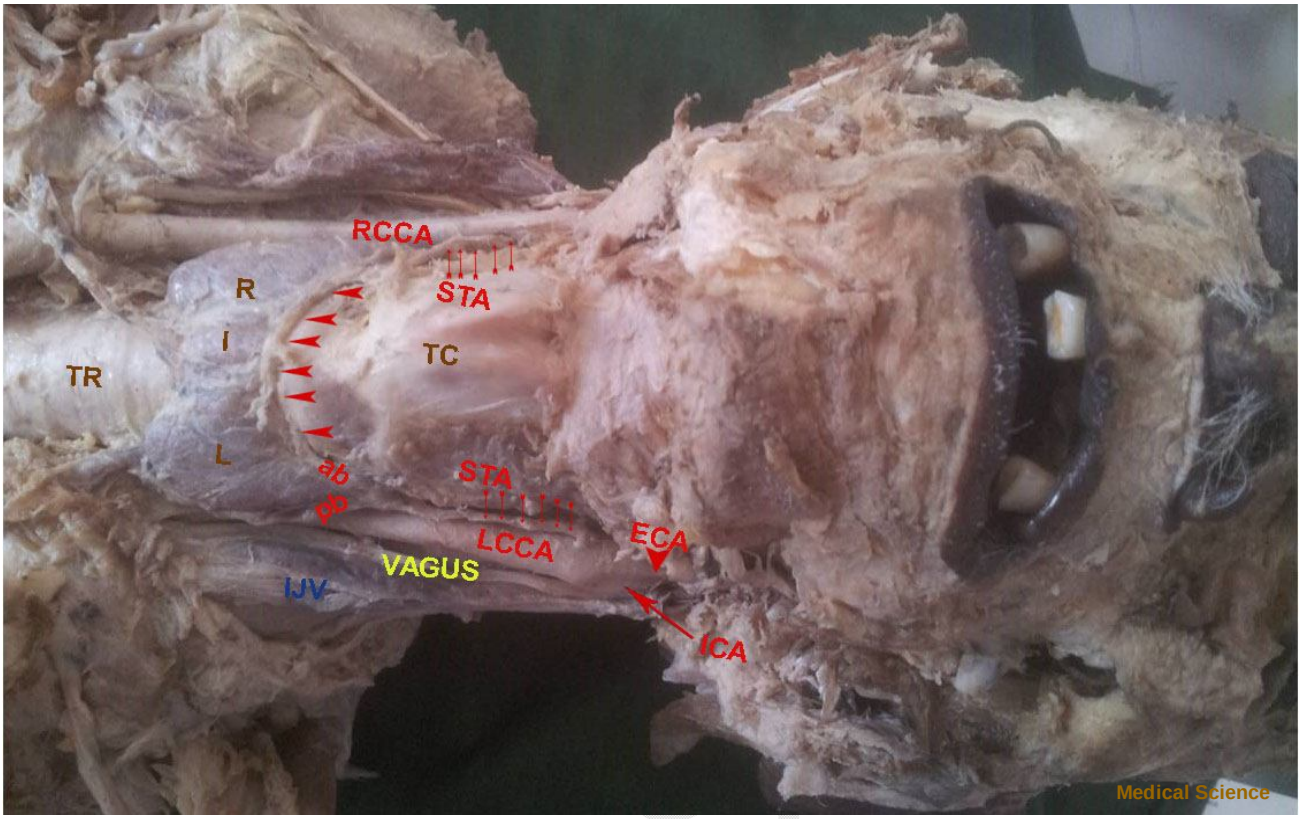

Figure 1

DISSECTED NECK SHOWING THE THYROID GLAND AND ITS BLOOD SUPPLY

RCCA – RIGHT COMMON CAROTID ARTERY
LCCA – LEFT COMMON CAROTID ARTERY
ICA – INTERNAL CAROTID ARTERY
ECA – EXTERNAL CAROTID ARTERY
STA – SUPERIOR THYROID ARTERIES
TC – THYROID CARTILAGE
R – RIGHT LOBE OF THYROID GLAND
L – LEFT LOBE OF THYROID GLAND
I – ISHTHMUS OF THYROID GLAND
TR – TRACHEAL RINGS
IJV – INTERNAL JUGULAR VEIN
ab – ANTERIOR BRANCH
Pb – POSTERIOR BRANCH

LARGE ARROW HEADS ARE SHOWING THE SUPRA ISTHMIC ARTERIAL ARCADE FORMED BY THE ANTERIOR BRANCHES OF BOTH THE RIGHT AND LEFT SUPERIOR THYROID ARTERIES. SMALL ARROWS ARE INDICATING THE LEFT AND RIGHT SUPERIOR THYROID ARTERIES.

Carotid Sinus:
The termination of the common carotid artery or the beginning of the internal carotid artery shows a fusiform dilatation called carotid sinus. For this reason the tunica media is thin and the tunica adventitia is relatively thicker. It acts as a baro-receptor and regulates the blood pressure.

Carotid body:
A small oval reddish-brown structure located behind the bifurcation of the common carotid artery is called carotid body. It acts as chemoreceptor responding to the changes in the oxygen and carbon-dioxide and pH content of the blood.

Isthmus:
It is the glandular tissue joining the right and left lobes of the thyroid gland. Isthmus means bridge. It extends from 2nd to 4th tracheal rings.

neck. They are bold and constant land marks defining dissection plane during radical neck surgeries. Variations in the bifurcation level and branching pattern of the common carotid artery and its terminal branches are frequent. Hence, for various procedures involving neck dissection, catheterization, reconstructive procedures of aneurysms, carotid end-arterectomy and intervention radiology the knowledge of the frequently to rarely occurring variations is mandatory. Doppler analysis of the superior thyroid arteries has been proposed to be a promising tool for the evaluation of thyroid function, particularly in patients with hyperthyroidism. High frequency Doppler shift signal from the superior thyroid artery was indicative of an overactive thyroid Doppler imaging.

2.1. Materials

An embalmed elderly male cadaver along with Routine instruments including Scalpel, Blade, Surgical forceps, Anatomical Forceps, Dissector, Metallic Scale with Calibrations along with a pair of gloves were used.

2.2. Methodology

Dissection method described in the standard dissection manual was followed. The infrahyoid group of muscles were identified and reflected. The sternocleidomastoid muscle and superior belly of omohyoid were displaced laterally. After reflecting the sternohyoid, sternothyroid muscles the thyroid gland was exposed. The fascia was removed from the lobes of the thyroid gland exposing its arteries and veins. Superior thyroid artery is traced from its origin to upper pole of the lateral lobe of the thyroid gland.

3. OBSERVATION

During the routine dissection hours for the first year MBBS students at Shadan Institute of Medical Sciences Teaching Hospital and Research Centre, The elderly male cadaver revealed a superior thyroid artery arising from Common Carotid Artery (CCA) on the left sided carotid triangle. The Superior Thyroid Artery (STA) arose from the left common carotid artery about 2 mm below the carotid bifurcation. The external carotid artery was seen medial and the internal carotid artery was seen lateral to the point of carotid bifurcation. It coursed forwards and downwards to reach the apex of the left lateral lobe of thyroid gland. At the apex it terminated by dividing into an anterior and posterior branch. The anterior branch anastomosed with the anterior branch of the right superior thyroid artery which arose from the right external carotid artery (as described in text books). The supra isthmic arterial arcade was complete above the superior border of the isthmus (Figure 1 & 2). The posterior branch anastomosed with one of the ascending branches of the inferior thyroid artery of the left side (Figure 2). The inferior thyroid arteries were present and normal. There was no other additional artery supplying the thyroid gland. The lobes of the thyroid gland were normal in size.

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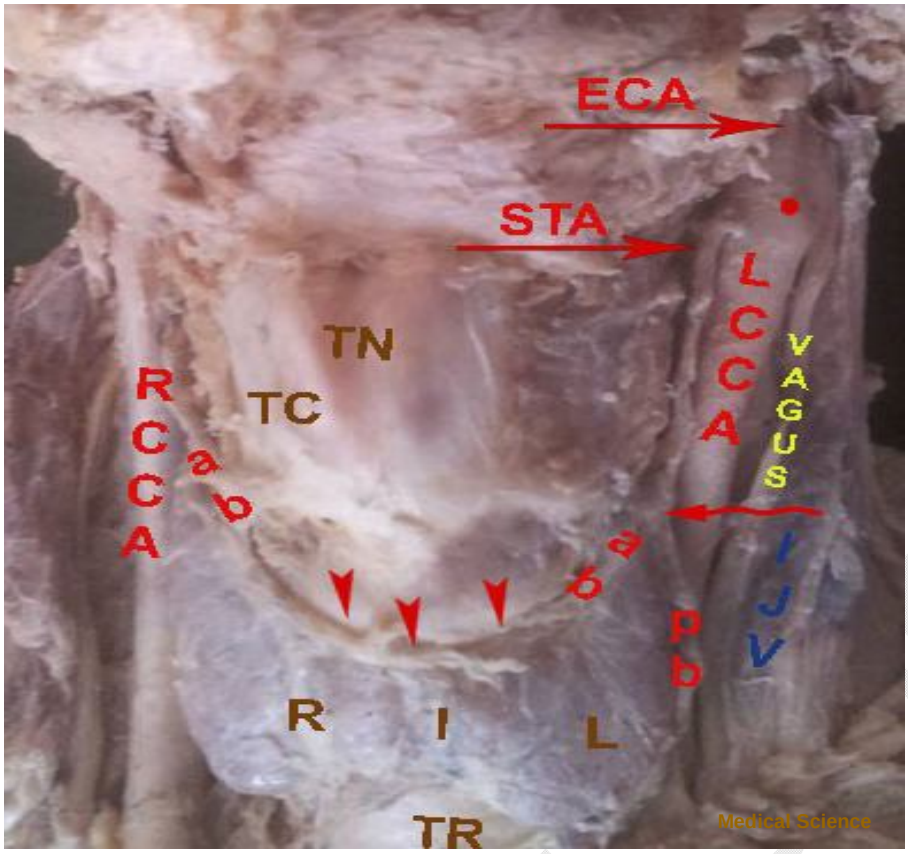

Figure 2

ANTERIOR VIEW OF THE NECK DISSECTION SHOWING THE THYROID GLAND WITH ITS BLOOD SUPPLY

RCCA – RIGHT COMMON CAROTID ARTERY
ICA – INTERNAL CAROTID ARTERY
STA – SUPERIOR THYROID ARTERIES
ab – ANTERIOR BRANCH
R – RIGHT LOBE OF THYROID GLAND
I – ISHTHMUS OF THYROID GLAND
IJV – INTERNAL JUGULAR VEIN
LCCA – LEFT COMMON CAROTID ARTERY
ECA – EXTERNAL CAROTID ARTERY
TC – THYROID CARTILAGE
pb – POSTERIOR BRANCH
L – LEFT LOBE OF THYROID GLAND
TR – TRACHEAL RINGS
TN – THYROID NOTCH

- SMALL ARROW INDICATES THE POINT OF CAROTID BIFURCATION.
- LARGE ARROW HEADS ARE SHOWING THE SUPRA ISTHMIC ARTERIAL ARCADE FORMED BY THE ANTERIOR BRANCHES OF BOTH THE RIGHT AND LEFT SUPERIOR THYROID ARTERIES.
- CURVED ARROW INDICATING THE POINT OF TERMINATION OF SUPERIOR THYROID ARTERY INTO ANTERIOR AND POSTERIOR BRANCHES

4. DISCUSSION

Although standard anatomical text books state that STA is a branch of ECA the literature reports it to be different. The incidence of STA arising from CCA was reported to be 47.5% (Lucev et al, 2000), 16% (Hollinshead, 1966), 10% (Md. Banna, 1990), 35.14% (Sanjeev et al, 2010) and 21% (Anitha, 2011). Rarely the origin of the artery is more than 5 mm proximal to the bifurcation (Livini, 1900). The origin was thought to extend up to the level of 1 cm proximal to the bifurcation (Adachi, 1928). In a 57 year old Thai male cadaver, the dissection revealed a variation in which the left superior thyroid artery was arising from the common carotid artery about 26.95 mm below the bifurcation of the common carotid artery. At 5 mm distal to its origin the superior thyroid artery divided into anterior and posterior branch (Nawaporn Techataweewan, 2003). Dissection of a Negro male cadaver revealed an anomalous right superior thyroid artery arising from the common carotid artery 27 mm proximal to the bifurcation into external and internal carotids (Stephen D. Smith and Robert S. Benton, 1978).

5. CONCLUSION

A profound knowledge of the anatomic characteristics and variation of the superior thyroid artery such as its origin, course and branching patterns is of indispensable value for a safe attempt in suitable position for catheterization and approach for surgeons in planning and performing procedure in neck surgery, the most feared complication is the rupture of the superior thyroid artery and its branches. Accidentally once cut or injured can cause extensive and uncontrollable bleeding. Iatrogenic injury can be avoided and unusually situations can be handled with confidence rather than being surprised.

SUMMARY OF RESEARCH

1. The present case is unilateral (left sided) vascular variation in which the left superior thyroid artery (STA) arose from the common carotid artery (CCA) about 2mm. below its bifurcation, instead of external carotid artery (ECA). At the apex of the left lateral lobe it terminated by dividing into anterior and posterior branches.
2. A profound knowledge of the anatomic variations of the superior thyroid artery including its origin, course and branching pattern is indispensable for surgeon as many procedures are done for the thyroid pathology like total bilateral lobectomy, total unilateral with partial contra lateral lobectomy and partial or subtotal lobectomy.
3. At times during thyroidectomies if profuse un controllable bleeding occurs from STA then ECA is ligated as it is first branch of ECA. But if STA is arising from CCA then ligation of CCA is impossible as its supplies the brain through the ICA. Hence, the operating surgeon should think of an alternate procedure for haemostasis. In case STA is arising close to the bifurcation of CCA, the operating surgeon must assess subjectively the feasibility of ligating the vessels.

FUTURE ISSUES

1. The surgical literature is roaring about the danger of injuring atypically originating large cervical arteries during the operative procedures on the thyroid gland (Catell, 1949 and Gorski, 1970). Disruption or tearing of superior thyroid artery (STA) or its branches by trauma or malignant invasion of the arterial wall could be fatal due to intra or post operative bleeding. Also, having a thorough knowledge of thyroid vasculature helps to avoid postoperative blood transfusions.
2. A new classification proposal on the origin of the superior thyroid artery is also suggested after studying 100 carotids (Konstantinos Natsis, 2011). According to him the superior thyroid artery originated from the external carotid artery in 39% and at the level of carotid bifurcation and common carotid artery in 61% of cases. The anterior branches of the external carotid artery were separate in 76% of cases, while common trunks between the arteries were found in 24% of the specimens. The Horizon is further opening up for vasculature of thyroid gland.
3. In the era of machine vision with the availability of noninvasive procedures a preoperative assessment of the vasculature of the thyroid gland is mandatory for safe and effective surgery

DISCLOSURE STATEMENT

There is no financial support for this research work from any funding agency.

ACKOWLEDGEMENTS

This publication is dedicated to my Dear Parents, Sri Tallapaneni Sankara Rao & Smt. Tallapaneni Bhavani Devi for all their concern and innumerable sacrifices they made for me. Thanks to J. George William the librarian Shadan Institute of Medical Sciences Teaching Hospital and Research Centre and his family for all the support extended. Thanks to S. Tataj Varma and his family for typing the manuscript. Thanks to all the students whom so ever I have taught for their constant inspiration and encouragement.

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